Space Weather Technical Forecast

Issued on Friday, 20 September 2024 at 13:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Low to Moderate activity with chance of M-flares. Active electron fluence likely day 2 onward (21 Sep).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C2.6 at 19/1527 from AR3825 in the southwest. This is a declining region, but maintains some complexity with a mixture of spot polarities resulting in a beta-gamma configuration. There are eight regions currently on the disc. The other regions remained relatively small and simple, but with the growth of a new simple region in the northwest, and a further new region rotating onto the southeast

No Earth-directed CMEs occurred.

Solar Wind / Geomagnetic Activity: Slightly disturbed solar winds continued to ease through the period. Speeds observed by ACE at L1 were Background to Slightly Elevated (350-450 km/s). Solar wind density remained below or around average. Interplanetary Magnetic Field, Bt, eased from Moderate to be mainly Weak from 9nT at first, to be mainly 4-8nT. The north-south component, Bz, was initially Moderate negative, at -8nT, but eased by 19/2100 UTC to vary +6nT and -4nT. Phi angle remained positive (away from the Sun). Geomagnetic activity was initially Unsettled to Active (Kp 3-4), but eased to be Quiet from 19/2100 UTC (Kp0-1).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at Background. High energy electron flux (greater than 2MeV) observed by GOES16 rose from initially Background, to be Moderate from 19/1510 UTC, with a brief period of High, peaking 1227 pfu at 19/1745 UTC. The associated 24-hour fluence showed a rising trend, but remained below Active, with the 20/0000UTC observation being 2.49e7 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Slight elevated solar winds are expected to ease to mainly background, but with a chance of slight enhancement on day 3-4 (22-23 Sep) from any interaction with the fast wind of small CH70 in the northwest. Mainly Quiet geomagnetic activity is forecast with isolated Unsettled intervals. There is a chance of Unsettled to Active intervals on day 3-4 (22-23 Sep) from any coronal hole enhancement that occurs.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at Background. High energy electron flux is forecast to be mainly Moderate, but likely reaching High at diurnal maximum, perhaps persistently High from day 2 (21 Sep). This brings a chance of Active Fluence, mainly day 2 onward.

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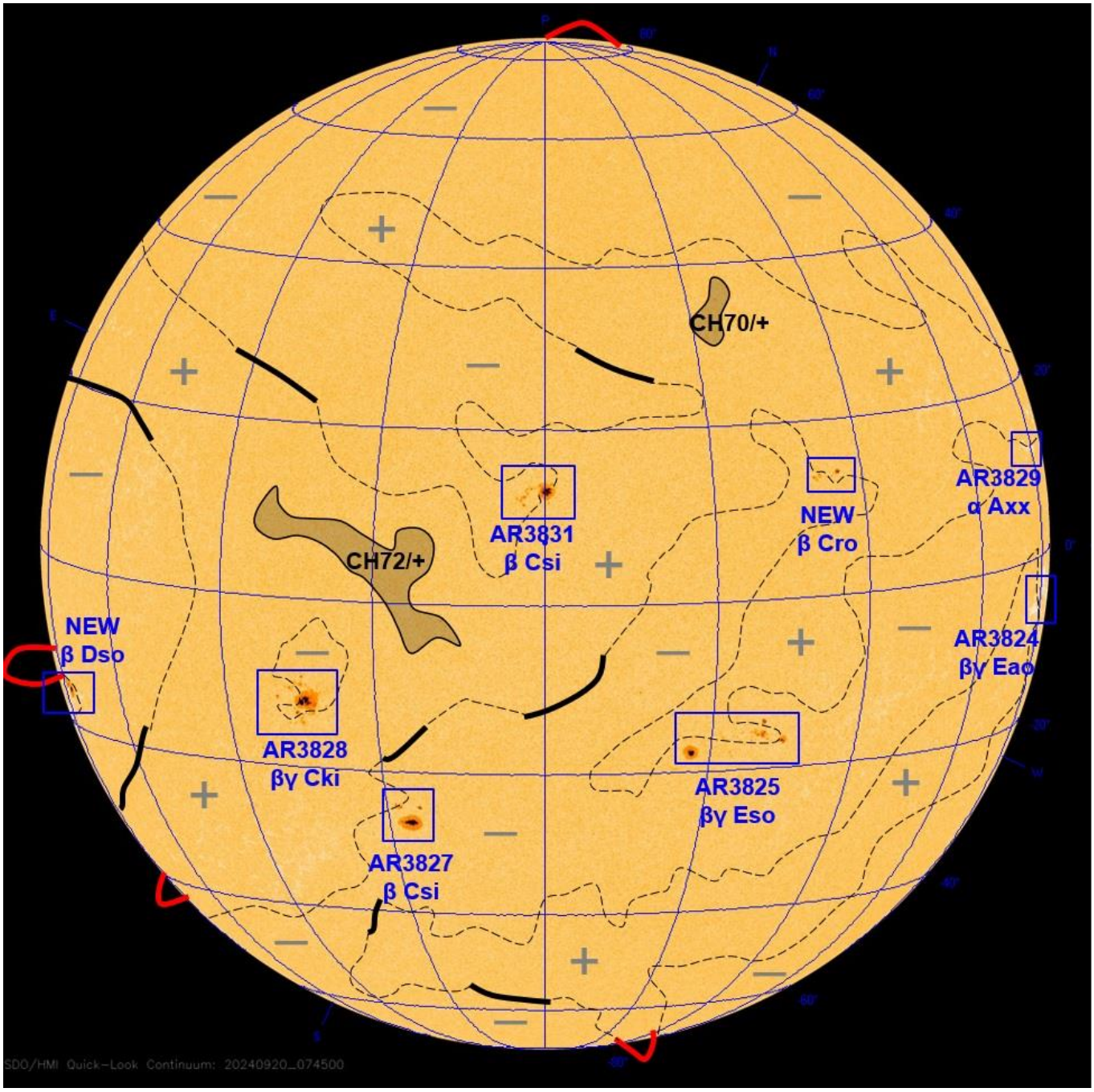
Figure 1. Solar Analysis Valid 20/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs.

Slightly elevated solar winds at first are expected to ease to Background, although a weak enhancement is possible on day 3 (22 Sep) from the small northern coronal hole CH71/-. This is low confidence however, due to its small size and northern location. However, given the September equinox occurs on day 2 (21 Sep), and the positive polarity of the Coronal hole, any enhancement may be sufficient to give a brief spell of Active.

Geomagnetic activity is forecast to be mainly Quiet with isolated Unsettled intervals and a chance of a spell of Unsettled to Active on day 3 (22-23 Sep).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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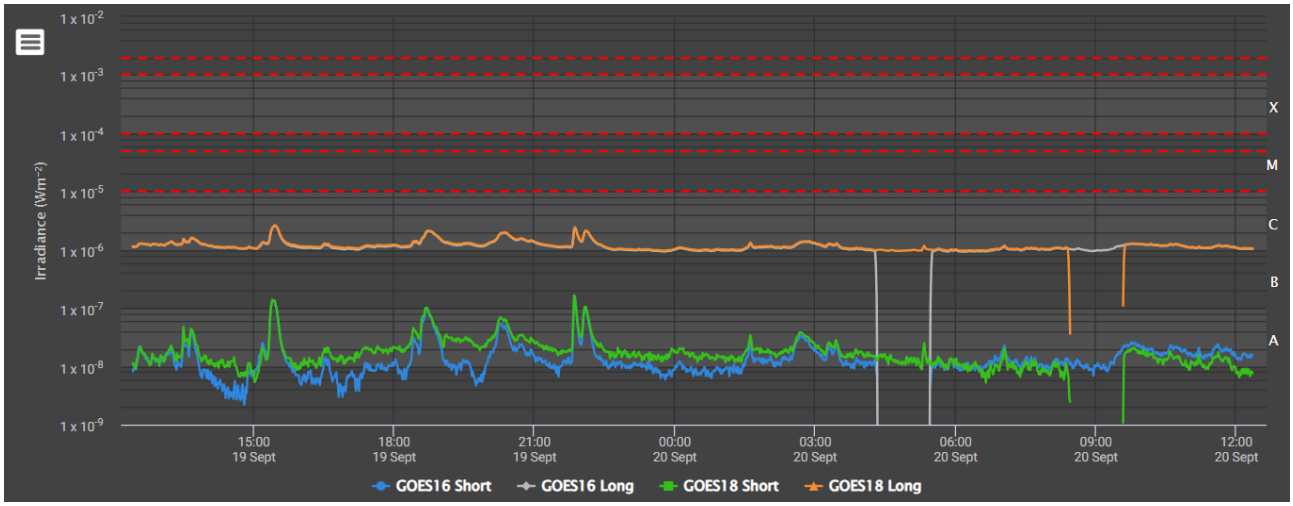
Radio Blackouts - X-Ray Flares:

Low to Moderate activity is expected with a chance of isolated M-class flares.

There are eight regions currently on the disc, although two will soon be moving over the west limb, including AR3824 which still has the potential to produce observable flares. The regions on the disc are generally simple, and mature, with AR3828 perhaps the most notable, with some slight complexity with its developing peripheral spots, around a large central spot. AR3825 also remains of interest, with a more complex beta-gamma configuration, but continues to decline. The other regions currently remain simpler and stable, although a new region on the southeast limb has the potential to reveal further complexity as it moves into a clearer view.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES 16/18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 reached the S1/Minor Radiation Storm level during 17 Sep but has since declined to Background. This was due to the X4.5 flare from AR3625 while on the limb, further enhanced ahead of the subsequent CME arrival late on 16 Sep. While this region has moved into a more favourable location, now on the southwest quadrant, it has also simplified reducing the potential for notable flares. With the other regions all relatively simple, there is only a slight chance of further proton enhancements.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy flux, as observed by GOES-16 at GEO has been persistently moderate since 19/1500 UTC, and is expected to rise to High at diurnal maximum. This is due to the charging of lower orbital levels, from the CME arrival overnight on 16-17 Sep, which, as solar winds have subsequently eased, have expanded outward. With no further notable solar wind enhancements forecast flux is likely to persist at Moderate to High at GEO, perhaps becoming persistently High from day 2 (21 Sep). Confidence does fall later in the period however, due to the potential for any weak solar wind enhancement from the arrival of fast wind from CH70/+. This could potentially cause a drop out in observed flux on day 3-4 (22-23 Sep).

The associated 24 hour fluence is expected to see a gradual rising trend, likely rising to around, or just above the Active level (1e8 total pfu) during day 2 (21 Sep). This rising trend is indicated by REFM, but is currently considered underestimated.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	60	60	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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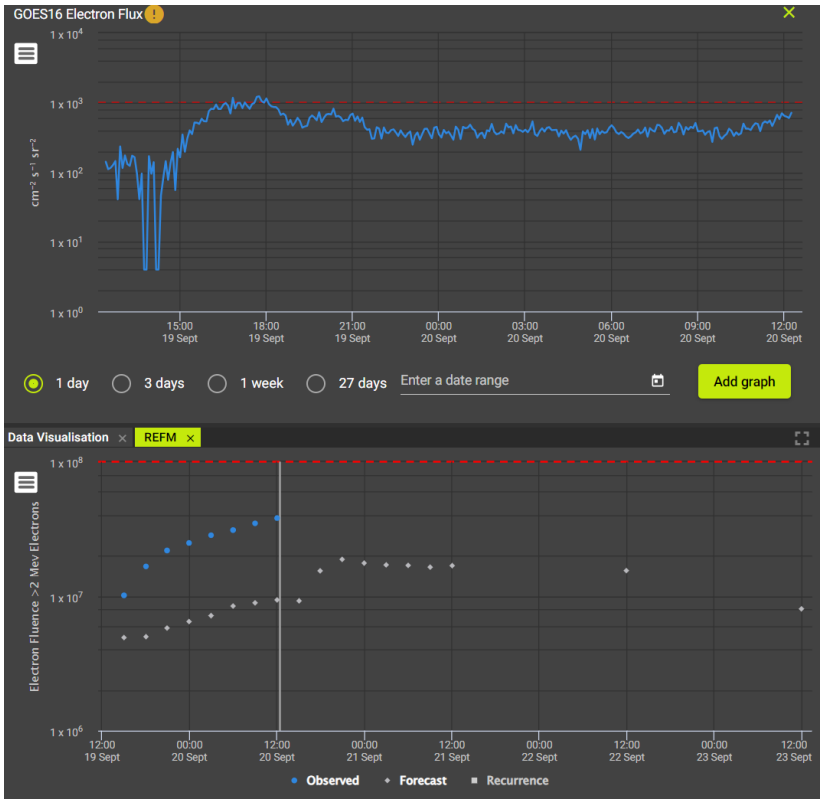
Figure 3: GOES-16 >2MeV Electrons and associated fluence with REFM



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